Sirfojee Rajah. 1829

1 March

THE REPORT

MADE TO THE

NATIONAL INSTITUTE OF FRANCE,

IN THE

MONTH OF DECEMBER, 1799,

BY

CITIZENS PORTAL, PELLETAN, FOURCROY, CHAPTAL, AND VAUQUELIN,

RESPECTING THE

ARTIFICIAL MINERAL WATERS

PREPARED AT PARIS

BY NICHOLAS PAUL, & Co.

WITH

EXTRACTS FROM THE REPORTS OF THE SOCIETY OF PHYSICIANS OF PARIS,

AND

THE FACULTY OF GENEVA;

AND

OTHER TESTIMONIES IN FAVOUR OF THE SAME WATERS:

TO WHICH ARE ADDED,

SOME NOTES AND OBSERVATIONS,

BY N. PAUL.

TRANSLATED FROM THE FRENCH.

LONDON:

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1802.

TO

BENJAMIN COUNT OF RUMFORD.

TO diminiſh the wants, and increaſe the comforts of Mankind, is ſurely one of the nobleſt purpoſes of Philoſophy. This, Sir, has ever been the object of your labours. You have deſcended from the ſublimeſt inveſtigations of Phyſical Science, to the humble taſk of bringing your diſcoveries to the level of vulgar comprehenſion; and (ſtill more to inſure their benefit to Society) you have condeſcended to inſtruct the Artiſt and the Workman in thoſe particulars, which are neceſſary to their practical application.

Confident of the intereſt you take in every thing that relates to the benefit of Mankind, I venture to claim your Patronage to an undertaking which has for its object

object a concern equally important and universal, the Preservation of Health, and the Relief of Disease. It is to no fanciful untried scheme, Sir, that I solicit your attention, but to an extensive and useful improvement of Chemical Discoveries, which had their rise in England, and which by unceasing efforts, and by the liberal support of enlightened men, I have happily succeeded in bringing to a greater degree of maturity in a foreign country.

Many years have elapsed, since I first engaged in a manufacture of Artificial Mineral Waters at Geneva. The distinguished approbation which that undertaking met with from the Physicians of that Place, and from the public at large, induced me to form another, and still more extensive one, of the same kind, at Paris. This, Sir, you have, not long ago, been pleased to visit; and the annexed Reports respecting it, which are drawn up by Committees selected from amongst the ablest Chemists and Physicians in France, will concur with your testimony to show that its claims to encouragement are not founded upon mysterious secrecy or specious pretence, but

reſt upon the firm baſis of ſcientific examination and approved uſe.

The characteriſtic liberality of the Britiſh Nation, entitles it, in an eminent degree, to ſhare in the advantages of whatever is calculated for the good of Society; but it has a peculiar claim to benefits derived from the application of diſcoveries which originated from itſelf. Under your auſpices, then, I chearfully ſubmit the matter to the teſt of public trial; and cannot doubt but the reſult will correſpond with that countenance and favour, which you have been pleaſed to beſtow upon the labours of,

SIR,

Your moſt obedient, and
very humble Servant,

Ns. PAUL.

Villier's Street,
10th of April, 1802.

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PREFACE.

PREFACE.

HAVING been strongly encouraged, by some friends in this country, to establish in London a laboratory, or manufacture of artificial mineral waters, upon the new plan, and with the several improvements which I have introduced abroad into that department of practical chemistry, I have lately repaired to England for that purpose. And although not quite a stranger in this City, where I resided for about fifteen months at a former period, I thought my first care ought to be to convey to the public an idea of my object, and of what I consider as my claims to its support. In this view I have been induced to publish the annexed REPORT made to the NATIONAL INSTITUTE of France by a select committee of eminent medical men and chemists, respecting the manufacture of mineral waters and the bathing establishment, which, within these two years, I have set on foot at Paris. This Re-

 port,

port, I have reaſon to ſuppoſe, will attract the public attention more effectually than any account or commentary of my own. It will ſhow that not only phyſicians and men of ſcience abroad have thought it worthy of their attention to inquire minutely into this eſtabliſhment, but that it has, in ſome degree, become in France an object of public concern.

To this Report I have only ſubjoined, in the form of an Appendix, a few Notes, the principal of which contain teſtimonies from the Faculty of Paris, and from the Phyſicians of Geneva. To the latter eſpecially, who have never ceaſed to give me all poſſible encouragement and aſſiſtance, I feel great pleaſure in expreſſing upon this, as upon every occaſion, my gratitude and regard.

Being myſelf a native of Geneva, and inſtructed early in life in ſome practical branches of mechanics, I often enjoyed the invaluable advantage of exerciſing my induſtry under the eyes and immediate direction of the late celebrated Profeſſor de Sauſſure, and of his worthy ſucceſſor, the preſent Profeſſor Pictet, who has never ceaſed to honour me with his friendſhip, and to aſſiſt me with his advice in all my undertakings. It is not

ſurpriſing

ſurpriſing, if, under ſuch circumſtances, I felt a ſtrong deſire to become acquainted with the elements of Chemiſtry and Natural Philoſophy, and endeavoured to apply to ſome uſeful practical purpoſe, the gradual progreſs which I made in the ſtudy of thoſe ſciences. Amongſt my firſt attempts of this kind, the imitation of mineral waters occupied the greateſt portion of my time and attention. In conjunction with two other gentlemen of Geneva, and with the aſſiſtance and enlightened ſupport of the Phyſicians of that Town, I ſoon met with very encouraging ſucceſs; and although my attention has at no time been excluſively confined to this particular purſuit, yet I have ever ſince been endeavouring to bring theſe firſt attempts to a greater degree of utility and perfection.

My intention, at preſent, is to confine myſelf to the preparation of all ſuch kinds of mineral waters as are either taken medicinally, or drank as a luxury, and as a ſalubrious article of diet, laying aſide the bathing eſtabliſhment, and all that relates to the *external* uſe of mineral waters. But the apparatus and laboratory are equally calculated to prepare any kind, or any quantities of

mineral waters, that may be required for any purpose whatever.

The public will now be conſtantly and regularly ſupplied with any of the mineral waters that are mentioned in the annexed Reports, and with ſuch other kinds, or ſuch new modifications of thoſe waters, as Phyſicians may think proper to ſuggeſt.

The mineral waters that will be kept immediately in readineſs are :

1. The STRONG SELTZER WATER.
2. The MILD SELTZER WATER *.
3. The STRONG SPA WATER.
4. The WEAK SPA WATER
5. The GASEOUS ALKALINE WATER (commonly called *mephitic)* either with carbonate of ſoda or carbonate of pot-aſh.
6. The SEIDLITZ WATER.
7. The OXYGENATED WATER.
8. The HYDRO-CARBONATED WATER.
9. The HYDRO-SULPHURATED OR HEPATIC WATER.

Theſe

* The epithets STRONG and MILD, or STRONG and WEAK, which have been arbitrarily uſed in the Report, for want of more appropriate

These waters, in general, will be prepared according to the analyfis mentioned in the annexed Report. But whenever it fhall appear proper to make any changes or additions to the *formulæ* now employed, fuch alterations will be made known to the public. It is impoffible, indeed, to have any fixed and conftant ftandard in the application of medicinal powers, the effects of which muft always be influenced by the differences of climate, of conftitution, and, above all, by the vaft variety of difeafes to which they are applied. Although I am far from claiming any pretenfions to medical knowledge, and make a point on the contrary to fubmit, upon every occafion, my opinions to the experience of medical men, I can eafily conceive that this clafs of medicines may be varied almoft indefinitely. It may be found, for inftance, that the Spa and Seidlitz water, mixed together, make an ufeful tonic purgative; or, that the Spa water

appropriate names, to contraft thefe two varieties of Seltzer Waters, cannot be confidered as ftrictly applicable to their real nature, fince the difference between them lies in the QUALITY rather than in the QUANTITY of the gas which they contain. This important difference will be found pointed out, and explained, in feveral parts of the Report. See pages 23 and 32.

may

may with advantage be mixed with the hydro-sulphurated water. Perhaps, alſo, the Seltzer water, blended with Seidlitz water, may be found preferable to that of Cheltenham; and, in ſhort, innumerous combinations can be obtained, by artificial means, that may be more effectual in particular caſes than thoſe which Nature affords.

With regard to the *names* that are uſed to diſtinguiſh the different kinds of mineral waters, it muſt be confeſſed, that a degree of confuſion cannot fail to ariſe from the deficiency of language in that reſpect. A variety of names have been arbitrarily introduced in the nomenclature of artificial mineral waters, which by no means always convey an idea of their compoſition. I ſhall not ſcruple, therefore, to adopt, for thoſe that are altogether artificial compounds, ſuch names as may appear more analogous to their real nature; but, in the imitation of natural waters, I wiſh to preſerve, as much as poſſible, the names of the natural ſprings which it is intended to imitate. It is ſcarcely neceſſary to add, that I ſhall have no kind of objection, whenever it may be thought proper, to ſubſtitute occaſionally, for the foreign artificial chalybeate, purgative, or hepatic waters,

thoſe of Tunbridge, Cheltenham, Briſtol, Bath, or Harrowgate, with their full proportion of gaſeous contents, according to the moſt accurate analyſis which we have of theſe waters, and which Dr. Saunders, in his late treatiſe on mineral waters, has collected with great care and perſpicuity.

With regard to the commercial part of this eſtabliſhment, and all that relates to the ſale of the waters, I beg leave to decline entering at preſent into any particulars on this ſubject. Notice of theſe particulars will be given to the public, from time to time, with an account of the different kinds of waters that will be kept in readineſs, and of the alterations which may occaſionally take place. I ſhall only obſerve, with reſpect to the œconomical part of this buſineſs, that a long experience, and careful compariſon of reſults, have induced me to prefer glaſs bottles, notwithſtanding their higher price, to the earthen ones commonly uſed for that purpoſe. My reaſon for this preference is, that the earthen bottles, from their porous texture, are apt to let a quantity of gas eſcape. I have experienced, on the contrary, that mineral waters could, with proper precautions, be tranſported in glaſs bottles to the diſtance of

three

three or four hundred miles by land, and could bear a voyage to the Eaſt and Weſt Indies, or indeed any voyage whatever, without being in the leaſt injured. And beſides, the tranſparency of glaſs has the additional advantage of affording an eaſy and certain means of aſcertaining their perfect cleanlineſs. In compliance, however, with the received cuſtom, both kinds of bottles will be uſed, and the public will have its choice of either.

I do not know how far the uſe of mineral waters has been introduced into the hoſpitals of this country; but I conceive that they may, in ſome inſtances, ſuperſede the uſe of wine or other expenſive articles. I ſhall be happy, if this ſhould be found to be the caſe, to ſupply public charitable Inſtitutions, on any terms that their general welfare may be thought to require.

REPORT,

&c. &c.

SECTION I.

Object of the Report:—Short account of the attempts hitherto made for the preparation of Artificial Mineral Waters.

IN the year 1755, M. Venel of Montpellier, presented to the Royal Academy of Sciences, an account of his succefs in imitating Seltzer water, by paffing through pure water the gas arifing from effervefcing fubftances. Chemifts then, for the firft time, began to conceive the hope of producing, by artificial means, mineral waters, exactly refembling thofe of Nature; and the prejudice before entertained, of its being impoffible to communicate to fimple water the fame principles and the fame virtues, that are found in natural mineral waters, gradually difappeared. M. Venel, indeed, confidered this gas as nothing more than common condenfable air; but, notwithftanding his

his error reſpecting the nature of ſuch waters, ſtill his proceſs was the firſt deciſive ſtep towards their ſucceſsful imitation. Soon after this, however, Dr. Black's diſcovery reſpecting fixed air, or (as it is now termed) carbonic acid, and the ſucceſſive diſcoveries of Dr. Prieſtley, the Duke de Chaulnes, and M. Ruelle, on the ſolution of this new aëriform acid in water, brought to light the true compoſition of ſpirituous or acidulous waters, and afforded the means of imitating them perfectly. The knowledge which was at the ſame time accumulated from all hands, reſpecting the various ſalts diſſolved in water; the manner of detecting them with certainty, and extracting them without alteration; the ſolubility of iron by the aſſiſtance of the carbonic acid; and that of the fetid or hepatic gas (ſulphurated hydrogen) in water, furniſhed the means of compoſing from their reſpective ingredients, artificial waters, in the ſeveral claſſes of acidulous, alkaline, bitter ſaline, ſimple and acidulous chalybeate waters, and likewiſe ſulphureous waters; of all which, ſcience had already ſhewn the important diſtinctions. Bergman was the firſt, who, in his valuable diſſertations, publiſhed in 1774, 1775, and 1778, on the preparation of cold waters, on the aërial acid, and on the analyſis of waters in general, gave eaſy proceſſes of imitating, from their ſcrupulous examination, the waters of Scidchutz, Seltzer, Spa, and Pyrmont; and alſo the hot and cold hepatic, or ſulphureous waters. He

ſhewed

ſhewed that no mineral water could be conſidered as exactly analyſed, unleſs it could be imitated in all its properties, by diſſolving in ſimple water the ſame principles that had been obtained from the compounded one; and he proved, that there was no exception to this general rule. Laſtly, after having pointed out the advantages which Sweden, in particular, might derive from the artificial preparation of the above mentioned waters, as well with reſpect to its commerce, as to its indigent ſick, and alſo to the advancement of the healing art, he gives ſome obſervations on the good effects of theſe factitious waters, which he had often found even ſuperior to the natural ones in hæmorrhoidal affections, in arthritic pains, and in obſtinate intermitting fevers. Thus did the illuſtrious Swediſh profeſſor leave far behind him all the imperfect eſſays which had been given before that period, and the vague or conjectural theories that had been offered reſpecting the analyſis of waters.

In the year 1779, M. Duchanoy publiſhed a treatiſe on the art of preparing artificial mineral waters, in which the modes of imitating them were detailed at greater length, but with very little information that was new, or different from what had been given before by Bergman. In this treatiſe, however, the author offered the firſt entire and ſyſtematic view of the artificial preparation of moſt of the mineral waters in uſe, according to the

 principles

principles of an art, which, not twenty years before, had been deemed impoſſible.

Thus was the imitation of mineral waters not only invented, but almoſt immediately carried to perfection, in the interval between the middle of the century and the year 1780; that glorious æra of chemical labours and diſcoveries, in which the ſcience underwent a complete change in France, and was built as it were upon a new foundation.

From that time, (1780) the art of imitating mineral waters has been continually improving; all the ſyſtematic works in Chemiſtry, as well as the numerous treatiſes on this ſubject in particular, preſenting facts and reſults, which have carried this part of the ſcience to a degree of perfection that leaves us ſcarcely any thing more to wiſh for.

It may therefore be ſaid, that the art of imitating mineral waters is now carried to its utmoſt limits; and that Chemiſts well acquainted with the reſources of their art, and ſkilful in their operations, will no longer find any difficulty in the preparation of them. Accordingly, for theſe twenty years paſt, the Chemiſts engaged in this department of their buſineſs, have ſatisfied the wiſhes of all phyſicians, who were ſufficiently acquainted with chemical ſcience, to put due truſt in it, and to be convinced, that it has at laſt diſcovered the proceſs of nature. In ſeveral well conducted laboratories of this kind, the waters of

Seltzer, Seidlitz, Spa, Balaruc, and Barege, are now prepared; they are alſo made either ſtronger or weaker than thoſe which nature affords, and their mildneſs or ſtrength thus regulated to the degree which the views of the phyſician require.

But, beſides that, either from local circumſtances, or from the inadequate capital of thoſe engaged, the buſineſs could not be carried on every where with the ſame facility and perfection, ſuch an undertaking could never have attained that extent in the variety or magnitude of its operations, that enables it to ſupercede the uſe of the natural mineral waters, and to ſupply the demands of a large and populous city, if men equally converſant with the chemical and mechanical ſcience neceſſary to enſure ſucceſs, had not conceived and executed the plan of eſtabliſhing genuine manufactures of artificial mineral waters upon an extenſive ſcale. Among the eſtabliſhments of this kind lately begun in France, that which Meſſrs. Paul and Co. have juſt ſet on foot, in the ſtreet of Mont-Martre, in Paris, deſerves to be particularly diſtinguiſhed *.

M. Paul, who, being at firſt connected with Mr. Goſſe, an ingenious apothecary of Geneva, has for ten years paſt prepared mineral waters with great ſucceſs at that place, and ſold annually up-

* This eſtabliſhment has ſince been removed to the ſtreet of Lazarre, near Tivoli.

wards of forty thousand bottles of artificial Seltzer water, presented to the National Institute, at its sitting of the 16th November, a paper on the preparation of mineral waters, the substance of which the Reporters will now proceed to state; they will afterwards describe the ingenious processes which they have seen employed in his laboratory, and give an account of the artificial waters themselves; they will then add some observations on their nature and comparative properties, and suggest certain improvements of which they appear to be still susceptible. Lastly, the Report will terminate with a statement of the results which the preceding facts have afforded, and of the conclusions which the Committee wish to lay before the Institute for its consideration.

SECTION II.

Abstract of the Memoir of Messrs. Paul and Co.

THE first part of this paper contains an account of the advantages which Geneva has, for ten years past, derived from the manufacture of artificial mineral waters*. The simple imitation of those waters, to which M. Paul first confined himself, has been followed by certain modifications suggested to him

* See Appendix, Note A.

by

by the phyſicians of that place; and eſpecially by the preparation of gaſeous waters, more highly impregnated than thoſe of Nature. The eſtabliſhment then, may be conſidered, both from its magnitude, and from the variety of mineral waters produced at it, as a real pneumatic laboratory. There are ſcarcely any mineral waters now imported into Geneva, whilſt thoſe of his manufacture are exported to the amount of forty or fifty thouſand bottles annually. The ſucceſs of this firſt attempt, has induced him to form a ſimilar eſtabliſhment at Paris. In this, are prepared nine kinds of artificial waters. The ſummary remarks that have hitherto been made upon each of theſe waters, are contained under the following heads:

1. The Seltzer Waters have been uſed with advantage in catarrhs, rheumatiſm, aſthma, and in bilious and putrid diſorders;—they prove diuretic and antiſeptic, even when externally employed;—they are ſerviceable in ſpaſmodic affections of the ſtomach; and they promote digeſtion. They may be taken mixed with milk, with wine, or with ſyrup of capillaire. M. Paul prepares them in two different ways: in the one, the carbonic acid (or fixed air) is diſengaged from chalk by ſulphuric (vitriolic) acid; in the other, it is ſeparated from the ſame ſubſtance by heat alone. The water prepared in the former mode has ſomewhat of a ſharp taſte and irritating quality, owing to a ſmall portion of the ſulphuric acid carried over

with

with the carbonic gas; but when prepared in the other, it is quite free from ſuch impregnation, and therefore better adapted to thoſe complaints in which irritation is to be avoided. With the carbonic acid gas, obtained in either of theſe modes, he likewiſe manufactures Seltzer water, either ſtrong or weak, according to the proportion of gas introduced.

2. The waters of Spa, which like thoſe of Seltz, are charged with a large proportion of carbonic acid, are, however, diſtinguiſhed from the latter by containing iron. To the properties of the Seltzer water, therefore, they unite the tonic and ſtomachic qualities which this metal is known to poſſeſs.

3. The gaſeous alkaline water, ſo highly commended in England, in caſes of gravel and ſtone, certainly affords very great relief to the pain which accompanies theſe complaints; and, according to the authors of the Memoir under conſideration, this effect muſt be attributed to the ſolvent power which this water imparts to the urine: they, therefore, think it proper to be imployed inſtead of the cauſtic alcali, and Stephens's medicine. Patients ſhould drink, every morning, two or three tumblers of this water, mixed with milk *.

4. The Seidlitz waters are the moſt eaſily imitated of any; and the artificial ones have exactly

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* Vide Dr. Saunder's Letter to Dr. Percival, in his Philoſophical, Medical, and Experimental Eſſays, vol. 3d, 1776.

the ſame cooling and purgative qualities, which are obſerved in thoſe that are produced by Nature.

5 The oxygenated waters, which contain nearly half their bulk of oxygen gas, and were firſt prepared by M. Paul, on the ſuggeſtion of the Phyſicians of Geneva, have perfectly anſwered the expectations formed of them, and deſerve the greateſt attention from medical men. Although poſſeſſed of no particular taſte or ſmell, they reſtore appetite and ſtrength, promote urine, reſtore the menſtrual diſcharge, and relieve ſpaſms of the ſtomach, and hyſterical complaints. The *Bibliothéque Britannique* contains a ſeries of intereſting obſervations on their ſalutary effects.*

6. The hydrogenated waters contain about one-third their bulk of hydrogen gas (inflammable air). They are uſeful in fevers with inflammatory ſymptoms, in which they diminiſh the frequency of the pulſe: they likewiſe allay pains in the urinary paſſages, promote ſleep, and give relief in ſome nervous complaints.

7. The hydrocarbonated waters (thoſe impregnated with a mixture of inflammable and fixed air) do not differ materially from the preceding.

8. The hydroſulphureous waters, prepared with hydrogen gas, mixed with a ſmall proportion of hepatic or hydroſulphureous gas, have the taſte and ſmell of rotten eggs, and reſemble the natural

* See the Appendix, note B.

ſulphureous waters. They are diaphoretic and diſcutient; very uſeful in obſtructions, in jaundice, and in affections of the meſentery. They admit of many varieties, according to the proportions in which the two gaſes are employed; and their external application is equally worthy of attention. From the great quantity of ſulphurated hydrogen gas with which they are charged, they become valuable as a lotion or bath in various foulneſſes of the ſkin; and when applied in a ſtream *(douche)* upon the part, they have proved ſucceſsful in curing ill-conditioned ulcers. They very advantageouſly ſupply the place of the natural ſulphureous waters, to thoſe patients whoſe circumſtances will not permit their undertaking expenſive journies for that purpoſe.

The author of the Memoir in queſtion, concludes it with two obſervations, equally important. The firſt is œconomical, and has for its object, the advantage of not only keeping at home the money which uſed to be ſent out of France, for the purchaſe of theſe waters; but of producing an influx of money for the ſame purpoſe from other countries. The other relates to the benefits which ſcience will probably derive from the proceſſes employed in this eſtabliſhment for the preparation of mineral waters. Such is the ſubſtance of the Memoir preſented by M. Paul to the Inſtitute; and the whole is written with that ſimplicity and preciſion which correſpond with the nature of the ſubject.

SECTION

SECTION III.

Processes used by Messrs. Paul and Co. in preparing the Artificial Waters;—Description of the Place in which the Business is carried on;—Proportions of the several Ingredients employed.

The Committee, on the invitation of Messrs. Paul and Co. went to the laboratory, where the waters are prepared. They were immediately struck with the simplicity of the apparatus; with the order that prevailed in their respective arrangement; the ingenious means employed for procuring water, and for filtrating it between the first reservoir and that from which it is taken when about to be mineralized. They were not less gratified with the perfection of the machines for obtaining the gases, and particularly that for obtaining the carbonic acid from carbonate of lime (chalk), either by heat, or by the addition of sulphuric (vitriolic) acid; but they admired, above all, the rapid mechanism by means of which the gases are compressed, and condensed in the water that is to receive them. Throughout the whole the Committee have seen the most ingenious mechanical contrivances united to the greatest chemical accuracy. They were every where struck

with the difference between operations of this kind, when conducted on this large ſcale, and the little, not to ſay inſignificant mode, in which they are uſually carried on. The apparatus, which the Committee will now proceed to deſcribe, is ſo diſpoſed in this laboratory as to prepare at once ſeveral hundred pints of mineral waters, and to impregnate them in the ſtrongeſt and moſt uniform manner.

The inventor of theſe proceſſes is ſo perfectly acquainted with all the apparatus employed in the French laboratories for inveſtigating the nature and uſe of elaſtic fluids; and has exerted ſo much ingenuity and preciſion in conſtructing his machines, that they might be conſidered as intended for chemical experiments of the moſt accurate kind. As the inventor, however, wiſhes to reſerve to himſelf, and his partners, the complete knowledge of his apparatus, and eſpecially of that employed to compreſs the gaſes (with which even the Committee were not made acquainted), it is not intended to enter into a minute deſcription of it. The Committee, however, think it their duty to give at leaſt a general notion of the proceſſes employed, that the Inſtitute may be enabled to appreciate the careful and enlightened management which preſides over this important eſtabliſhment. Enough will be ſaid to convey an idea of the merits and advantages of this manufacture, but not to furniſh the means of imitating it; and the Committee will thus have fulfilled the taſk

affigned to them refpecting the refults of thefe proceffes, without infringing the rights of the inventor with regard to the machinery by which they are performed.

Two forts of apparatus, equally fimple and ingenious, and carried to a degree of perfection which may render them very ufeful, even in accurate experiments, are employed, the one for difengaging the gafes by heat, the other by effervefcence. The firft is a metallic cylinder, which paffes through a furnace, and is provided at each extremity with contrivances that enable the operator to fee what is going on within it at any time, during the procefs; and alfo to collect, transfer, meafure, and purify the gafes thus feparated. In fhort, this apparatus exhibits an affemblage of all the moft exact and ufeful contrivances furnifhed by modern chemiftry, for obtaining and examining elaftic fluids.

From the extremity of this apparatus, (which is divided by a partition, and has on one fide the furnace and cylinder, on the other, the receivers, and whatever elfe is neceffary to the collecting, meafuring, and purifying gafes), there arife moveable tubes that can be lengthened, fhortened, and directed at pleafure, fo as to convey the gafes into a pump, by which they are forced into ftrong clofe cafks, where they meet with the filtered water, as it iffues from a contiguous apparatus, and are diffolved in it by the joint affiftance of agitation and preffure.

preſſure. This apparatus is applied to the condenſation of the carbonic acid, and likewiſe to that of the oxygen and hydrogen gaſes.

The ſecond kind of apparatus is appropriated to the obtaining elaſtic fluids by efferveſcence, and is ſtill more ſimple than the former. Although it reſembles thoſe uſed in our laboratories, and conſiſts of a receiver furniſhed with tubes, and ſtop-cocks, yet M. Paul has brought it to a degree of perfection, ſimplicity, and convenience, which renders the operation more eaſy, expeditious and certain, than before. Its performance is ſo exact, that nothing whatever is waſted: it collects the whole of the gas; and is ſo contrived, that the efferveſcing materials can never ſwell ſo much as to reach the firſt water through which the gas paſſes: in ſhort, every thing relating to it, whether reſpecting time or ſpace, is turned to the greateſt advantage. The mechaniſm, which produces theſe effects, is at the ſame time of wonderful ſimplicity; and ſuch as denotes in the inventor the moſt perfect experience in the ſeveral operations, as well as a complete acquaintance with the acknowledged inconveniencies attending the machines in common uſe, and with the means of obviating them. The gas furniſhed by this proceſs, is drawn out by the ſame pump, and conveyed into the ſame caſks as that which is expelled by heat.

With regard to the compreſſing machine, (the ſtructure of which was not explained to the Committee,

mittee, as the inventor wishes to keep it secret) it is sufficient for us to say, that it answers the purpose in the most effectual manner; as the various gaseous waters, specimens of which were prepared before the Committee, contain a larger proportion of elastic fluids (especially of those that are known not to be soluble in water, except by the assistance of pressure) than any that have been made hitherto. The Committee saw him prepare in less than two hours, two small casks of Seltzer water, as well with the carbonic acid expelled by heat, as with the same gas disengaged by means of the sulphuric acid. This process is so simple in all its parts, as to be attended with no difficulty, irregularity, or loss of time: the greatest neatness prevails throughout the whole of the operation. The saline and other fixed matters that enter into the composition of some of these waters, and especially those of Seltz, Seidlitz, Spa, &c. are put in their due quantities, well mixed and powdered, into each bottle, before it is filled with the gaseous water, which is drawn immediately from the cask where it receives the impregnation. Even the mode of drawing off the gaseous water from these casks is brought to the highest degree of improvement. The hissing noise, and the bursting of the bottles occasionally, at the moment they are corked, convinces the spectator, that the water is super-saturated with gas; and, that, notwithstanding a small quantity escapes, the liquid still retains

much

much more of it than any artificial water hitherto prepared.

To this ſketch of the new proceſſes which M. Paul employs for the ſolution of gaſes in water, the Committee think it proper to add a ſhort account of the various ingredients which enter into the ſeveral mineral waters prepared by him; in order that phyſicians may thereby be enabled to direct their uſe according to the principles contained in them, or to ſuggeſt ſuch modifications, in their preparation, as they may think deſirable*. The following are the proportions, which, according to the written ſtatement of M. Paul, to the Committee, are contained in each bottle of twenty ounces meaſure.

1ſt, The STRONG SELTZER WATER contains, in each bottle of 20 ounces,

Carbonic acid obtained by efferveſcence, 5 times the bulk of the water employed.

Carbonate of Lime, ... :	4 grains
Magneſia, ...	2 grs.
Carbonate of Soda, . . : . .	4 grs.
Muriate of Soda, ...	22 grs.

2dly, The MILD SELTZER WATER contains

Carbonic acid evolved by means of heat, and mixed with a little hydrogen gas, 4 times its bulk.

* See the Appendix, Note C.

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The 4 ſalts in the ſame proportions as in the *ſtrong* Seltzer water.

3dly, The SPA WATER contains, in each bottle of 20 ounces:

Carbonic acid obtained by efferveſcence, 5 times its volume.

Carbonate of Lime, ...	2 grains
Magneſia, ...	4 grs.
Carbonate of Soda, ...	2 grs.
Muriate of Soda, ...	⅓ gr.
Carbonate of Iron, ...	½ gr.

4thly, The STRONG SPA WATER contains:

The ſame as the preceding, but with a double proportion of iron.

5thly, The GASEOUS ALKALINE WATER contains:

Carbonic acid by efferveſcence, 6 times its volume.

Carbonate of Pot-aſh, . . .	144 grains

6thly, The SEIDLITZ WATER contains:

Carbonic acid by efferveſcence, 5 times its volume.

Sulphate of Magneſia, . . .	144 grains

7thly, The OXYGENATED WATER contains:

Oxygen gas half its volume.

8thly, HYDROGENATED WATER contains:
Hydrogen gas, one third of its volume.

9thly, HYDRO-CARBONATED WATER contains:
Carbonated hydrogen gas, two-thirds of its volume.

10thly, The WEAK HYDRO-SULPHURATED WATER contains:
Half its volume of hydrogen gas, mixed with one-thirtieth part of ſulphurated hydrogen gas.

11thly, The STRONG HYDRO-SULPHURATED WATER contains:
Half its volume of hydrogen gas, mixed with one-fourth of ſulphurated hydrogen gas.

SECTION IV.

Examination of the Waters prepared in the Eſtabliſhment of Meſſrs. Paul and Co.

THE Committee did not confine its enquiry to the inſpection of the laboratory of mineral waters, and the proceſſes of fabrication; they thought it proper to bring the reſults themſelves under examination. For that purpoſe, a few bottles of each of the waters, prepared by the above mentioned proceſſes, were carried, carefully corked and

and sealed up, from the laboratory of Messrs. Paul and Co. to that of one of the members of the Committee, where they were examined, not with all the accuracy required in the analysis of an unknown mineral water, (as such a precision would have been superfluous), but with sufficient care and attention, to give perfect satisfaction as to the nature of their contents. The following circumstances were observed by the Committee, three days after the bottles had been in their possession, during which time they were kept in a cool and shaded place.

The bottles containing Seltzer water, especially that which M. Paul calls *Strong Seltzer water*, produced at the moment they were uncorked, a considerable effervescence, accompanied with a remarkable hissing noise. The cork was several times blown out with a loud report, and abundance of bubbles continued to escape from the fluid for several hours. In decomposing this water accurately by lime water, the precipitate obtained indicated a little more than three times its volume of carbonic acid. The reagents indicated the presence of the different salts that had been dissolved in the water.

The same circumstances took place with the weak Seltzer water; this however yielded a little less gas than the former; yet it produced a similar hissing and effervescence, and one of the corks was blown out.

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The ſtrong Spa water had blackened its cork. Some light yellowiſh clouds were ſeen floating in it; it was briſk and ſparkling, and had a diſtinct ferruginous taſte; it reddened on the addition of nut-galls.

The weak Spa water was briſker and more acidulous than the former; it had leſs of the metallic taſte, and was not ſo much blackened by the addition of gallic acid. Some light yellowiſh clouds were alſo perceived in it.

The gaſeous alkaline water which was much leſs effervescent than any of the former, and had a ſweetiſh taſte, contained twice and half its volume of carbonic acid. The preſence of the alkali was made conſpicuous by every poſſible reagent; and its power in weakening the acidity, was abundantly well marked, eſpecially when compared to the Seltzer and Spa waters.

The Seidlitz water, beſides the properties of a gaſeous water, exhibited thoſe of a ſolution of ſulphate of magneſia, or Epſom ſalt.

The oxygenated, hydrogenated, and hydrocarbonated waters, differed but little either in taſte or properties from common water. They produced neither hiſſing noiſe, on being uncorked, nor any very ſenſible effervescence, on coming in contact with air; and, in general, they did not offer any obvious analogy with gaſeous waters. They ſcarcely emitted a few bubbles of oxygen, or hydrogen gas; and they did not produce

upon any reagent, effects sufficiently marked to indicate clearly the presence of the gases with which they had been impregnated by pressure; yet the small portion that they did yield, had undergone no alteration, but retained the characters, the one of oxygen, and the other of hydrogen gas, in a state of tolerable purity.

Finally, the hydro-sulphurated waters, without producing any agitation, or effervescence, appeared a little turbid, and emitted a slightly fœtid smell. The nitrous acid, and acetite of lead, clearly indicated the presence of sulphur. The precipitate produced by the first of these reagents, was more distinctly marked in the strong, than in the weak sort.

All the phenomena and characters that have just been enumerated and described, were equally discovered in the principal kinds of the same mineral waters, some months after they had been sent from Geneva to Paris, where they had been kept in cellars; there was this difference however, that the quantity of carbonic acid in the first kind, was sensibly diminished, although not so much as might have been expected, since the stronger sort still contained twice and half its volume of carbonic acid.

SECTION V.

Obſervations on the Modes of Preparation, and on the Nature of the Waters.

THE general ſurvey of the eſtabliſhment, the inſpection of the apparatus, the communication made by M. Paul himſelf, of his receipts for the factitious waters, and the examination of theſe waters, both freſh and old, as prepared by him at Geneva, and at Paris, led the Committee to ſome obſervations, which it may be uſeful to communicate to the Inſtitute: they relate both to the general proceſſes uſed by the inventor, and to the ſpecial nature of each of the mineral waters in particular. The principal object of theſe obſervations is to ſuggeſt ſome modifications or improvements of which theſe artificial liquids appear ſuſceptible, and which may have ſome influence on their ſucceſs in the cure of diſeaſes.

1ſt, Although there can be no doubt, that the machines and proceſſes of M. Paul, enable him to impregnate water with a greater quantity of gas than any of the proceſſes hitherto employed, theſe waters have conſtantly appeared, on examination, to contain leſs gas than the author ſtated. It ſhould not be inferred from this circumſtance, that

that M. Paul does not actually poſſeſs the means of condenſing in the water, by his compreſſing machine, as much as 6 times its volume of carbonic acid, and of aſcertaining with certainty, the reality of this condenſation; but it is certain, that theſe waters ſuffer conſtant and ſucceſſive loſſes, either at the moment the cork is applied and ſealed in the bottle, or in keeping, or uncorking it; as the rapidity and noiſe with which the cork is drawn, ſufficiently denotes. It muſt be obſerved, however, that more elaſtic fluid is obtained from theſe waters, by the pump and other ingenious mechaniſm that the author has conſtructed for that purpoſe, than by the proceſſes uſed by the Committee; but there is reaſon to believe, that notwithſtanding his ingenious contrivance for diſengaging the gaſes from the water, and aſcertaining their quantity, ſtill there may be ſome ſource of error; ſince ſolutions of lime and barytes, uniformly indicate a ſmaller quantity of theſe gaſes *. This obſervation, however, (the only one the Committee will have to make on the general ſcheme of M. Paul,) ought rather to convey a more favourable idea of his eſtabliſhment, as will appear from the following remarks on each kind of artificial water in particular.

2dly, The ſtrong Seltzer water, although appearing to contain, when chemically examined,

* See the Appendix, Note D.

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leſs carbonic acid than it was made to abſorb in the proceſs of preparation, is ſtill found to be loaded with a greater quantity of this gas than any of the artificial waters hitherto made. Bergmann, and all the authors that have followed him, mention only a volume of gas, either equal, or a little ſuperior to that of the fluid; whilſt M. Paul's waters conſtantly yielded upwards of *three times* their volume of gas. But this great proportion of carbonic acid, which gives to the ſuperabundant gas ſuch a conſtant tendency to eſcape, and to the water ſuch a remarkable effervefcent quality, may be regarded as ſuperfluous as to the medicinal properties of the water. Twice its volume of gas would be ſufficient to render it ſuperior to any of thoſe that nature affords. Patients do not take in any thing like the quantity of gas contained in M. Paul's factitious water; a great deal of it being diſengaged in uncorking the bottles, and a great deal again in pouring out the water and ſwallowing it. But it muſt be acknowledged that the briſk and ſparkling quality is generally agreeable, and particularly well adapted to ſome domeſtic purpoſes; ſo that, although it is not indiſpenſable in the medicinal adminiſtration of theſe waters, the author nevertheleſs, deſerves credit for this additional merit. The Committee, however, does not entertain the ſame opinion with reſpect to the addition of carbonate of lime and magneſia, in the artificial Seltzer water. They believe

believe with Bergmann, that these earthy salts, without being so noxious as the illustrious professor thought, and without occasioning the obstructions which he apprehended might result from them, cannot at least add any useful quality to this water, and may, perhaps, diminish those which it derives from its other principles *.

3dly, The preparation of the weak Seltzer water, with carbonic acid extracted by heat, was a very happy invention. It is certain that this water has not the same sharpness, and does not occasion the same irritation as is observed in that which is prepared with carbonic acid obtained by effervescence. The two observations on the superabundance of acid, and on the presence of the earthy salts, apply to this kind as well as to the former. It may moreover be observed, that it would, perhaps, be desirable that this water should not contain the hydrogen gas which M. Paul states to exist in it; and as the origin of this gas is well known, he might easily avoid it by substituting in place of his iron cylinder, an earthen one, and for the chalk which he employs, some powdered marble or calcareous spar. The water which he pours into the cylinder, and which he finds so efficacious in facilitating and hastening the disengagement of the carbonic acid, would then no longer give birth to the hydrogen gas above mentioned. But it must be acknow-

* See the Appendix, note E.

 ledged,

ledged, that this remark, although tending to carry a little farther the degree of perfection which this preparation is susceptible of, ought to be considered as of little importance, with respect to the nature and salubrious effects of this kind of mineral water*.

4thly, In both kinds of M. Paul's factitious Spa waters, there always appears a cloudy precipitate of carbonate of iron, notwithstanding the superabundance of carbonic acid, which is contained in these waters, and the exact and careful method by which the iron is added. M. Paul puts into the bottle, previous to the introduction of the salts, and of the gaseous liquid, a quantity of solution of iron in acidulous water, the proportion of which he varies according as he wishes to prepare weak or strong Seltzer water. The precipitation of the iron must, therefore, be owing to the previous preparation of this solution; and it would be very easily prevented either by preparing the ferruginous solution later, or by leaving out the two earthy salts, which are added to no useful purpose. However, notwithstanding this partial precipitation of iron, there remains enough of it to give to the water the metalic taste, the property of blackening on addition of gallic acid, and the medicinal qualities that are known to belong to this class of waters.

* See the Appendix, note F.

5thly, The gaseous alkaline water is prepared with carbonate of pot-ash, evidently for the sole purpose of giving it exactly the same quality as that known under the name of alkaline mephitic water, so much used in England, and so strongly recommended by Dr. Jugenhoutz, in cases of calculus. Yet the natural gaseous alkaline waters are all solutions of carbonate of soda, with excess of carbonic acid. The waters of Vichy, of Bard, and several waters of Puy de Dome and Montd'or, are of that kind. If Physicians should wish to have waters prepared exactly similar to those which we have just mentioned, it would be very easy to M. Paul to introduce that slight modification in his process, by substituting the carbonate of soda to the carbonate of pot-ash. He might, at the same time, continue to prepare the alkaline gaseous water with pot-ash, if it should continue to be found useful in some urinary complaints; but it does not appear at all probable, in the present state of animal analysis, that an alkaline carbonate should possess a solvent power over calculi formed of uric acid or phosphate of lime; and these two kinds of concretions are known to be the most frequent of all.

6thly, Although the Seidelitz water, with which we are acquainted at Paris, does not, by any means, contain a portion of gass approaching to that which is introduced into the waters which M. Paul prepares; this addition, probably recommended

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by medical men, cannot be attended with any inconvenience: it would be eaſy, however, in caſe it ſhould be found adviſeable, to diminiſh at pleaſure the proportion of gas, as alſo to vary and increaſe the proportion of ſulphate of magneſia, in order to render this water more active and more purgative. Perhaps, alſo, it will be found proper that M. Paul ſhould add to his factitious Seidelitz water, the ſmall proportion of muriate of magneſia, which has been found in the natural Seidelitz water, and which, conſidering its ſharp and ſtrong taſte, ſeems to deſerve being ranked amongſt its active principles.

7thly, The preparation of oxygenated water, and the ſolution of oxygen gas, in twice its volume of water, by means of a ſtrong preſſure, is a real and important diſcovery, both in philoſophy and medicine. There is every reaſon to believe, that it will become uſeful in ſeveral arts; and it may alſo account for ſome natural phenomena, hitherto but little underſtood. This water, however, does not appear to be a true ſolution of oxygen gas; the gas ſeems merely to be condenſed and retained in it by preſſure, ſo as to eſcape from it eaſily, whenever the preſſure is either diminiſhed or removed; and it is for that reaſon, no doubt, that we could not extract from the water even one-third of the quantity which the author ſtates. Although the taſte, and other properties of the water thus oxygenated, ſeem not

to differ from thofe of common water, it would not be reafonable to raife any doubts on the effects which the phyficians of Geneva have obtained from it; which effects they have carefully defcribed in feveral numbers of the *Bibliothéque Britannique*, while treating of the modern pneumatic chemiftry. From the refearches which one of the members of this Committee had already made on that part of medicinal chemiftry (feveral years before Meffrs. Rollo and Cruckfhanck, who feem either to have forgotten or to have been ignorant of his previous fpeculations on the fubject), the Committee is perfuaded, that water impregnated with oxygen gas, may become one of the moft powerful remedies, and moft ufeful refources in the healing art. It will, perhaps, in many inftances, fupply the place of the acids, the oxyds, and metallic falts, with regard to their oxygenating operation, or, at leaft, affift and fupport them in promoting that effect. But this is quite a new field of inveftigation, where much remains to be done before it is poffible to draw any pofitive conclufions.

8thly, As to the hydrogenated and hydro-carbonated waters, notwithftanding the hopes which the Phyficians of Geneva had, with fome foundation, conceived of thefe waters, when they induced M. Paul to attempt their preparation; the trifling effects that have been obtained from them are fuch as might have been expected from the

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ſmall quantity of hydrogen gas which they contain, and the extreme weakneſs with which it adheres to the liquid; this however by no means appears to be a ſufficient reaſon for laying aſide theſe two kinds of artificial waters. Time alone can ſhow what may be expected from their uſe; and the theory of elaſtic fluids, in ſhowing, that hydrogen and oxygen are contraſted in their virtues, indicates that their utility ſhould not be deſpaired of, until their true properties have been carefully aſcertained.

9thly, Finally, the ſulphurated waters appeared to the Committee to be not ſufficiently impregnated with ſulphurated hydrogen gas. This gas is united, in this inſtance, with ſome pure hydrogen gas, forming only one thirty-ſecond part (in volume) of the weak ſort of theſe waters, and one-fourth of thoſe of the ſtronger kind. There does not appear to be any advantage in introducing into the water *pure* hydrogen along with the *ſulphurated* hydrogen gas; the former, as it is well known, diſſolves in water, but very ſparingly, and only by means of a conſiderable preſſure, and therefore can but ſerve to diminiſh the ſolubility of the latter, which, of itſelf, is tolerably ſoluble. Bergmann propoſed to imitate the ſulphureous waters by the ſimple addition of ſulphurated hydrogen gas; and no chemiſt, after him, had ever propoſed to aſſociate this with the pure hydrogen gas. At any rate, the proportion of ſulphurated hydrogen gas might be

be varied according to circumſtances, and it could be carried much beyond the limits indicated by M. Paul, whoſe means however are more than ſufficient to fulfil every indication *.

RECAPITULATION AND CONCLUSION.

FAR from wiſhing to offer the foregoing obſervations, as objections to the eſtabliſhment juſt deſcribed, they have only been intended to place in a more meritorious and conſpicuous light, the great extent and utility of which it appears ſuſceptible. Thoſe obſervations ought to prove, at the ſame time, the high value which the authors of this inquiry ſet upon the undertaking, and the eſteem which they have conceived for the inventor. But that there may remain no doubt in that reſpect, they will terminate this report by a ſummary account of the advantages which may be expected from this new manufacture of mineral waters, and of the motives that led them to the concluſions they have drawn.

1ſt, Since chemiſtry has determined the nature and proportion of principles (particularly of the gaſes), diſſolved in mineral waters, art poſſeſſes all the means of imitating them. The proceſſes of M. Paul ſhow, that he is completely poſſeſſed of

* See the Appendix, note G.

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those means, and has a perfect knowledge of all the resources that art can afford.

2dly, The new establishment described in this Report, offers a laboratory much superior to any hitherto known; here are no longer seen the narrow means commonly used in chemical laboratories, nor is the operation any longer confined and restrained by the complication of a thousand other experiments, going on at the same time. It is a true PNEUMATIC LABORATORY, a real manufacture, in which the same course of operations, performed with great care and upon a large scale, constantly lead to uniform results.

3dly, To the common, but inadequate processes of ordinary laboratories, M. Paul has substituted a compressing machine, which introduces into the water, not only a quantity of carbonic acid gas three times as great as could be done before, but other elastic fluids also, which had been hitherto considered as totally insoluble.

4thly, The Seltzer and Spa waters prepared in this establishment, are made much stronger, and much superior to those which were formerly prepared in shops and laboratories, and this entirely by means of the new process of compression which Mr. Paul employs for saturating the water with carbonic acid gas. The weak Seltzer water, prepared with carbonic acid evolved by heat, has certainly the advantage of being much less irritating, and therefore much better adapted

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to certain cafes, than that prepared with the fame acid difengaged by effervefcence, which, in fuch cafes, might be attended with prejudicial effects.

5thly, The oxygenated and hydrogenated waters are acquifitions of confiderable importance in the healing art. In Phyfics and Chemiftry, they will afford new means of inveftigation; and in agriculture, and in the arts, they may perhaps become new inftruments equally ufeful and valuable.

6thly, The Seidlitz waters, and the fulphureous artificial waters, are entirely fimilar to the natural fprings which they are intended to imitate.

7thly, The preparation of the various kinds of medicinal mineral waters, by the methods of M. Paul, is fufceptible of modifications and improvements, readily to be obtained. It would be eafy, by means of fome flight changes in the quantities of the different ingredients, and the management of the proceffes, to increafe, diminifh, and otherwife modify their effects.

8thly, The new eftablifhment, confidered in a general point of view, offers to the healing art a feries of medicinal preparations, that may fulfil in practice a variety of indications of cure; and, with the affiftance of a very few other means, prove adequate to the treatment and relief of a great number of difeafes.

 9thly,

9thly, The preparation of mineral waters having thus become eaſy, and being carried on upon a large ſcale, the indigent ſick, and the hoſpitals of every deſcription, will find, in the products of this pharmaceutical eſtabliſhment, curative means that they could much leſs eaſily have obtained from their natural ſource, on account of the expence of travelling, or that which neceſſarily attends the importation of thoſe waters from diſtant countries.

10thly, Finally, this preparation of artificial mineral waters, carried on upon ſuch an extenſive ſcale, as to ſupply conſtantly a great number of individuals, is calculated to create in France a new branch of induſtry, not only important to the healing art, but alſo to commerce and national proſperity, by preventing the exportation of conſiderable ſums of money, which, on the contrary, will now be imported for the ſame object from neighbouring countries.

The Committee, therefore, is of opinion, that the Inſtitute ſhould give the moſt diſtinguiſhed approbation to the proceſſes of Meſſ. Paul and Co. for the preparation of artificial mineral waters, and declare, that they have perfectly fulfilled their intended object of ſupplying medicine with artificial remedies, that are in many inſtances EVEN SUPERIOR to thoſe which nature affords*.

NATIONAL

* See the Appendix, Note H.

NATIONAL INSTITUTE 21ſt Frimaire, the 8th Year, (December 1800.)

(Signed) VAUQUELIN.
CHAPTAL.
PELLETAN.
FOURCROY.
PORTAL.

The Inſtitute approves the Report, and adopts its concluſions.

26th Frimaire, the 8th Year.

(Signed) CUVIER.

APPENDIX.

NOTES OF THE EDITOR.

Note A.—Page 6:

I BEG leave to tranſcribe here the following declarations of the *Phyſicians of Geneva*, and of the *Society for the Encouragement of the Arts*, in which thoſe learned and reſpectable bodies were pleaſed to expreſs publicly, ſeveral years ago, their approbation of my firſt attempts in the imitation of mineral waters.

DECLARATION OF THE FACULTY OF GENEVA.

" We underſigned, Phyſicians of the Faculty
" of Geneva, declare, that having ſubmitted to
" our examination the factitious mineral waters
" prepared by M. Paul, and particularly thoſe of
" Seltzer and Spa; and having communicated to
" him our obſervations on this ſubject, with a
" view to aſſiſt him in the ſucceſs and improve-
" ment of his undertaking: we have ſeen, with
" ſingular

" singular pleasure, that the means invented and " employed for this purpose, by the said M. Paul, " surpass all the attempts that have been made " hitherto in the imitation of these waters; that " Science, united to industry, has produced in " his hands the happiest effects, since he can " now, with perfect ease, furnish the public with " a constant supply of artificial mineral waters, " stronger and more energetic than the same " waters, when issuing from the laboratories of " Nature; so that we can positively assert, that " M. Paul, by his laudable efforts, has suc-" ceeded in rendering himself equally interesting " to Physicians, and useful to humanity, in the " cure of diseases."

Geneva, 26th August, 1796.

(Signed) Solomiac, M. D.
and Senior of the Faculty.
Vieusseux, M. D.
Odier, M. D.
Vignier, M. D.
Dunant, M. D.
Manget, M. D.
Miroglio, M. D.
Butini, Jun. M. D.
Veillard, M. D.

DECLARATION OF THE SOCIETY FOR THE ENCOURAGEMENT OF THE ARTS:—COMMITTEE OF MECHANICS.

" We underſigned declare, that having, at M. " Paul's requeſt, attended at his houſe, in order " to witneſs the proceſs, by means of which he " impregnates his factitious mineral waters with " carbonic acid gas; and having examined his " ſeveral apparatus minutely: we have found " them conſtructed upon excellent principles, " and capable of condenſing in water, quantities " of this elaſtic fluid, ſuperior to thoſe that are " contained in natural mineral waters, however " carefully preſerved. The energy of thoſe appa- " ratus can be varied at pleaſure; and their " action is ſuch as to impregnate rapidly a very " conſiderable quantity of water. They are alſo, " from their nature, equally applicable to the " condenſation of any other elaſtic fluid with " which water can be impregnated, thus ſupply- " ing the art of healing with new means of cure, " and opening to Phyſicians and Chemiſts a " new and intereſting field of obſervation.

" M. Paul has ſhewn himſelf, in the conſtruction " of theſe apparatus, deeply converſant with me- " chanics, and natural philoſophy; and we have " obſerved, with great ſatisfaction, that this diſ- " tinguiſhed artiſt has had chiefly in view, for a " long time paſt, in his ſucceſſive labours, and in

" the

"the gradual developement of his talents and
"industry, the relief of suffering humanity; and
"we seize with pleasure this opportunity of ex-
"pressing to him our distinguished approbation."

Geneva, 27th August, 1796.

(Signed) M. A. PICTET, Professor of Natural Philosophy, and President of the Committee of Mechanics, of the Society for the Encouragement of the Arts.

ODIER, M. D. Member of the same Society.

BUTINI, Jun. M. D.

NOTE B.—Page 9.

The observations here alluded to, were published by Dr. Odier, Professor of Medicine at Geneva, in the 8th and 10th volumes of the *Bibliothéque Britannique*, annexed to an account of Dr. Rollo's late publication on the treatment of Diabetes and Syphilis, and to that of Mr. Cavallo's work on Factitious Airs. The name of Dr. Odier, and the most justly deserved reputation of the publication in which these observations are recorded, induced me to translate them here verbatim.

"To the methods of oxygenation and de-oxygenation, mentioned by Dr. Rollo, (says Dr. Odier,

Odier, *Bibliothéque Britannique, Sciences & Arts*, vol. viii.) we muſt add another, a very ſimple one, which we have employed for ſome time paſt at Geneva with ſucceſs. I mean the gaſeous waters prepared by M. Paul. I have already mentioned them in this journal, (vol. vii.) and promiſed to ſpeak of their effects as ſoon as they ſhould be ſufficiently aſcertained by experience. I haſten to keep my word, in order to facilitate the obſervations that other practitioners may make on this ſubject.

" The oxygenated waters, which contain about half their volume of oxygen gas, are perfectly pure in every other reſpect. This gas is not incorporated in the water, by means of any baſis, but merely by powerful compreſſion. It is therefore neceſſary, when the waters are uſed, that they ſhould be conſtantly kept in bottles well corked, the bottle being reverſed upon the cork, in a pot of water; and it ſhould be opened only at the moment of uſing it, when they ſhould be drank off as rapidly as poſſible, one glaſs at a time, carefully corking the bottle between each glaſs. With theſe precautions, I have found that this remedy, (which is far from diſagreeable, the waters being without any taſte whatever), reſtores the appetite and ſtrength, promotes the ſecretion of urine, allays ſpaſms of the ſtomach, particularly when they are accompanied with hyſterical

 ſymptoms,

ſymptoms; and prevents their return, eſpecially if the fits are periodical.

"I attended ſome time ago, the mother of a family, 40 years of age, ſubject for many years paſt to hyſterical fits, which had lately returned with increaſed violence, in conſequence of great mental emotion. They began with a cramp in the ſtomach, accompanied with a tightneſs in the throat, ſuffocation and contraction of her limbs. This ſtate, which was totally exempt from fever, laſted with all its violence about an hour, after which the ſymptoms gradually abated, and left the patient with no other ſenſations than a ſort of general uneaſineſs, which remained for ſome hours. The next day ſhe was perfectly well; but the following day, exactly 46 hours after the commencement of the preceding attack, it returned with the ſame violence, the ſame ſymptoms, and in the ſame manner.

"She was in her third fit, when I was called in; I at firſt gave her the bark in large doſes, 4 days ſucceſſively, without effect. I afterwards tried the CARDAMINE PRATENSIS a remedy firſt recommended by Sir George Baker, and from which I have ſeen very good effects in nervous diſorders. It failed in this caſe, though the doſe adminiſtered was an ounce a-day. At length I uſed the oxygenated waters, in doſes of a glaſs every two hours, and from the firſt bottles the remedy ſucceeded

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the fits returned no more, and the patient has been in good health ſince.

" Another mother of a family of the ſame age, and nearly the ſame conſtitution, was attacked lately by a bilious fever, during the courſe of which ſhe had ſeveral fits of hyſterics, which manifeſted themſelves by ſpaſms in the ſtomach, tightneſs of the throat, complete extinction of voice, with a ſenſation of ſuffocation, great anxiety, involuntary tears, &c. Theſe fits at firſt recurred at irregular periods. I preſcribed the oxygenated waters, but they produced ſome ſymptoms of dyſuria, which obliged me to ſuſpend the uſe of them. A few days afterwards, this effect having ceaſed, and the fits having become periodical, returning regularly every 18 hours, and having reſiſted very powerful anti-ſpaſmodics, I had again recourſe to the oxygenated waters, which now ſucceeded perfectly, and prevented any return of the paroxyſms. The dyſuria, which theſe waters are apt to occaſion, again returned, but not till after the patient was cured; and as ſhe then only took the waters by way of precaution, the uſe of them was diſcontinued without inconvenience.

" I ſhall not enter at preſent into any further detail of caſes. I have ſeen ſeveral analogous inſtances in which the oxygenated waters have done great ſervice. It appears to me, upon the whole, that they may be ranked amongſt the number of good antiſpaſmodic tonics. I have ſeen them

 ſucceed

ſucceed extremely well in the caſe of a return of melancholy, which had before been cured by the black oxyd of manganeſe, which remedy had afterwards failed. I have known alſo a dropſical caſe, in which they were attended with aſtoniſhing diuretic effects. But they ſometimes irritate the urinary paſſages, and even the inteſtinum rectum, ſo much as to produce accidents of dyſuria, teneſmus, ſanguinolent ſtools, &c. I have witneſſed a ſingular effect from theſe waters, that I conſider as being of the ſame nature. I was called in conſultation, the 21ſt of laſt March, in the caſe of a girl of eleven years of age, who after the ſmall-pox had a jaundice, which was ſucceeded by hyſterical affections, which returned frequently, and manifeſted themſelves by violent cramps in the ſtomach, accompanied by ſuffocation, &c. Several antiſpaſmodics had been tried without effect. I adviſed the oxygenated waters. They had a complete ſucceſs, and prevented at once the return of the paroxyſm; but during the firſt three days, the young patient complained of a ſenſation of extreme cold in making water, as if her urine was frozen. When I was informed of this ſingular effect, I was deſirous of examining the temperature of the urine by the thermometer, but it was too late; the ſymptoms had ceaſed, and from that time the patient has enjoyed good health. It is probable, that this ſenſation of coldneſs was nothing more than a ſlight irritation, ſimilar to

that

that which occaſioned the dyſuria. Theſe accidents, however, are not laſting; and I only mention them to put others in the way of juſtly appreciating the manner in which theſe waters act.

"I do not know whether I am miſtaken; but it appears to me, that theſe oxygenated waters might be uſed in bleaching linens, with much more eaſe and advantage, than the oxygenated muriatic acid, from which ſo much uſe has been derived for the ſame object. It would not be difficult to the talents of the ingenious artiſt, who has diſcovered the method of preparing them on a ſmall ſcale, to give a greater extenſion to his proceſſes, and to make theſe waters flow as a river, which watering our fields, would powerfully aſſiſt our manufactures of printed linens, and revive amongſt us a branch of induſtry of conſiderable importance.

"The hydrogenated waters, which contain about one-third of their volume of hydrogen gas, have no particular taſte, and require, in being uſed, the ſame precautions as the oxygenated waters. They have not hitherto appeared to me to have any very deciſive effects. I have employed them, with tolerable ſucceſs, in caſes of fever, proceeding from, or accompanied by, inflammatory irritation. They have almoſt always, in theſe caſes, evidently diminiſhed the frequency of the pulſe; but this effect, which would be very important if it was durable, never laſted long. They have

alſo

alſo ſucceeded in abating, for ſome little time, the pains of dyſuria, and thereby facilitating the evacuation of urine. They have alſo ſometimes procured ſleep; but, upon the whole, I have not ſeen yet any cure performed by their means, and the good effects which patients experience from the firſt bottles, are little or not at all ſenſible after a few days. I have heard, however, that they had effectually removed ſpaſmodic diſorders, which had reſiſted other remedies.

"I may ſay as much of the hydro-carbonated waters, which do not appear to me to differ eſſentially from the hydrogenated waters, or to be ſuperior to them in efficacy. It is ſingular, that the hydro-carbonate is not diſcoverable in the water by any taſte, provided they are carefully prepared, ſo as to prevent a taſte of empyreuma, which they eaſily contract.

"The hydro-ſulphurated waters, which are prepared by impregnating water with hydrogen gas, mixed with one ſixty-fourth part of hepatic gas, have a ſmell and taſte of rotten eggs, which makes them reſemble the ſulphureous thermal waters. I have employed them, with more decided ſucceſs than the ſimple hydrogenated or hydro-carbonated waters, in catarrhal fevers, in conſumptions, in old and inveterate coughs. But I have not yet had the good fortune to derive permanent effects from them, whether it is becauſe the remedy being diſagreeable, it is difficult to

continue

continue it long enough to obtain any confiderable advantage; or whether, becaufe it is naturally lefs efficacious than would at firft have been imagined; or, in fhort, whether it may not be, that the waters are too weakly impregnated with the principal gas which diftinguifhes them from the other mephitic waters. They might perhaps be employed to advantage, either internally, as diaphoretics and folvents, that is to fay, as favourable to the abforption of the folid parts, (I have feen, in this refpect, fome good effects from them, though temporary); or externally, in the form of lotions, in herpetic diforders of the pforic kind.

"I have not yet employed them in this manner; but I prefume, that to render them ufeful, by external application, it is neceffary that they fhould be much ftronger, which might be very eafily effected."

In the other article above mentioned, (Bibliothéque Britannique, Sciences & Arts, vol. x.) Dr. Odier expreffes himfelf as follows:

"I beg leave to take this opportunity of recommending to the attention of Phyficians, a mode of oxygenation, much more convenient than that which is obtained by the pneumatic method. I mean the oxygenated waters, which we continue to ufe in a very extenfive and fuccefsful manner.

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" 1ſt, We every day witneſs their good effects, in caſes of ſpaſms in the ſtomach and inteſtines, and eſpecially thoſe that attend hyſterical affections, and proceed from debility, rather than from plethora, or any irritating cauſe. I cured, by means of theſe waters, a Spaniſh lady, from 25 to 30 years of age, who had been for a length of time daily attacked with violent ſpaſms, which were originally brought on by ſtrong emotions of mind, and afterwards conſiderably increaſed by fatigue, and continual vomitings, which ſhe had ſuffered in a ſea voyage. All the known antiſpaſmodics had been uſed without ſucceſs; at length the oxygenated waters were tried, which ſoon produced a complete cure.

" 2dly, Theſe waters have been found uſeful in affections of the cheſt, of an aſthmatic, rather than of a conſumptive nature. I ſaw a woman of 55 years of age, who had been ſubject for many years paſt to difficult reſpiration, attended with occaſional fits of coughing and ſuffocation, take theſe waters, and derive a relief from them, which no other remedy had been able to afford. I knew likewiſe a gentleman about 50, rather of a weakly conſtitution, who, in conſequence of a catarrhal fever, had ſuffered for a long time, from a weakneſs in the cheſt, ſo that the leaſt effort of voice fatigued him extremely, an inconvenience he felt the more ſeverely, being profeſſionally

obliged to give leſſons, when he could neither ſpeak nor read aloud, without extreme fatigue. He had a conſtant ſenſation of cold, numbneſs, and weakneſs in the legs and thighs. After having unſucceſsfully tried ſeveral other remedies, I at length uſed the oxygenated waters, which anſwered perfectly well, and procured him very conſiderable relief.

3dly, " The oxygenated waters have alſo appeared to me very uſeful in caſes of weakneſs and lingering convaleſcence, after febrile diſeaſes; and when the patient, without having any local complaint, found it difficult to regain his ſtrength, his appetite, and ordinary ſpirits. I have taken them myſelf after an ague, which had weakened me conſiderably, and I derived very good effects from them.

4thly, " They have ſucceeded extremely well as diuretics, in caſes of anaſarca, accompanied with oppreſſion and livid countenance. One of my colleagues attended a patient, labouring under a diſorder of this nature, who had taken ſeveral remedies without effect, and whom the oxygenated waters cured as it were by enchantment, by producing an abundant evacuation of urine. This cure, which was effected ſeveral months ago, has proved permanent.

" When I began to uſe the oxygenated waters, I obſerved that, with ſome patients, it brought on diſtinct ſymptoms of dyſuria. I have ſince found,

 however,

however, that this remedy feldom produces fuch an effect; and, on the other hand, I have fometimes fuccefsfully ufed the hydrogenated waters to allay this fymptom.

" However, neither the hydrogenated waters, nor the carbonated, nor even the hydro-fulphureous, have hitherto appeared to me efficacious remedies in thofe cafes, in which they have been ufed. The oxygenated waters alone have completely anfwered the hopes we had conceived of them, and that to fuch a degree, that M. Paul has already difpofed of a confiderable quantity of thefe waters. They are contained in bottles of the capacity of about one pint, which, by the means of compreffion, invented by this ingenious mechanic, are impregnated with half their volume of pure oxygen gas. Patients take one or two of thefe bottles in the day. I confider this remedy as a valuable acquifition, that will, no doubt, prove permanent in practice. I am far however from thinking, that we have yet any clear notion of the manner in which it operates. Does the oxygen actually pafs into the chyle, and from hence into the blood? Or does it act merely on the ftomach, and the inteftines? Its effects appear fo quick, that I fhould be rather inclined to adopt the latter opinion. In this point of view, there would be but a very diftant connection between this mode of adminiftering oxygen, and the oxygenation of the blood by the lungs. But fuch is the

the origin of most discoveries. We seek for one thing, and find another."

NOTE C.—Page 16.

In the month of July, 1800, the same year in which this Report was read before the Institute, another Report on the same subject was presented to the SOCIETY OF MEDICINE OF PARIS, the substance of which perfectly coincided with the former. But from the account this Report gives of the formulæ, employed in the fabrication of the waters, it will be seen that some slight changes had already been effected in the formulæ, in consequence of the hints suggested in the Report to the Institute. In the Seltzer and Spa waters, the carbonate of lime had been suppressed; and, on the other hand, the following new varieties of waters had been added, either to be drank, or used as baths:

Water of Vichy.

Carbonic acid by effervescence, twice its volume.

Carbonate of Lime, ...	2 grains
Carbonate of Magnesia, . .	½ gr.
Carbonate of Iron, ...	1/10 gr.

 Carbonate

Carbonate of Soda, ...	24 grs.
Sulphate of Soda, ...	6 grs.
Muriate of Soda, ...	4 grs.

Water of Buſſang.

Carbonic acid by effervefcence, 3 times its volume.

Carbonate of Soda, ...	6 grains
Carbonate of Iron, ...	$\frac{1}{8}$ gr.

Water of Vals.

Carbonic acid by effervefcence, 3 times its volume.

Muriate of Soda, ...	13 grains
Sulphate of Iron, ...	$\frac{1}{2}$ gr.
Sulphate of Alumine, ...	$\frac{1}{2}$ gr.
Carbonate of Iron, ...	$\frac{3}{4}$ gr.

Water of Contreaeville.

Carbonic acid by effervefcence, one-twelfth part of its volume.

Sulphate of Lime, ...	6 grains
Carbonate of Lime, ...	4 grs.

Water of Balaruc.

Carbonic acid by effervefcence, twice its volume.

Calcareous

Calcareous Earth	4 grains.
Muriate of Soda	12 grs.
Carbonate of Pot-ash . . .	4 grs.

Water of Plombiéres.

Carbonic acid by effervescence, one-twentieth part of its volume.

Sulphate of Lime	3 grains
Carbonate of Lime	2 grs.
Sulphate of Magnesia . . .	1 gr.

Water of Barége.

This water contains in each bottle 10 or 12 drops of the following preparation:

Common water	8 ounces
Sulphate of Soda	½ dram
Carbonate of Soda	2 ounces
Muriate of Soda	2 drams
Oil of Petroleum	12 drops.

The Report of the Society of Medicine, from which the foregoing statement is extracted, concludes as follows:

"From the report you have just heard, we propose to the Society to give to the establishment "of Messrs. Paul and Co. for the preparation of "artificial mineral waters, the most authentic approbation, acknowledging the excellence of "their methods, the perfection of their products, "and

" and the utility which both national intereſt and " the health of Citizens may derive from their " enterprize."

(This Report is ſigned) PELLETIER, FOURCROY, P. JOSSE, DELUNEL, LAFISSE.

NOTE D.—Page 23.

The quantity of gas condenſed in the water, in the firſt inſtance, is exactly indicated during the operation by the nature of the proceſs itſelf. As for the deficiency of gas obſerved by the reporters, on examining the contents of the bottles, they have partly accounted for it themſelves. I have only to remark, that in order to extract all the gas from the water in which it has been condenſed, I have found that the combined aſſiſtance of a boiling heat, and of the pneumatic pump, were abſolutely required; and the apparatus alluded to in the report, is adapted to this double purpoſe. But even with the aſſiſtance of this apparatus, I have reaſon to believe that a portion of gas always remains intimately united with the water, in which it is detained, partly by the earthy ingredients, partly, perhaps, by the water itſelf.

NOTE

Note E.—Page 25.

I have occaſionally tried to ſuppreſs the earthy carbonates, in conſequence of the objection ſuggeſted, in the Report on the ſuppoſed inutility or noxious effect of theſe ſalts. But ſeveral medical men having had reaſon to ſuſpect that the waters were not always ſo effectual after this ſuppreſſion, I ſhall continue to add theſe ſalts whenever phyſicians ſhall not think proper to order their ſuppreſſion.

Note F.—Page 26.

The reaſon why an earthen cylinder has not, in this operation, been preferred to an iron one, is, that the former, from it's porous texture, particularly when expoſed to a ſtrong heat, cannot anſwer the purpoſe near ſo well as one made of caſt iron. But care is taken that the cylinder be previouſly ſo oxydated as to be very unfit for decompoſing water, and the very ſmall portion of hydrogen that may ſtill be diſengaged, has never been found to alter in the ſmalleſt degree the good qualities of the water. Perhaps, upon further examination, this ſuppoſed portion of hydrocarbonate may be found to conſiſt partly of the gaſeous oxyd of carbone, which has lately attracted the attention of Chemiſts. This, however, is but a

mere

mere conjecture, which I ſhall take the earlieſt opportunity of verifying by experiment.

Note G.—Page 31.

Some ſulphureous or hepatic waters are found in Italy, which appear to be conſiderably ſtronger than any of thoſe that are found in other parts of Europe. In the month of Auguſt, 1801, the Medical Society of Paris gave, in their journals, an account of a work of conſiderable length, ſoon to be publiſhed, on the mineral waters of Naples or its environs. The author of this Treatiſe (which I underſtand is now printing) is Attumonelli, Profeſſor of Phyſiology, and Phyſician to the chief hoſpital of Naples. It appears from his account, that Nature has brought together, in that particular ſpot, all the ſtrongeſt remedies of this ſort that ſhe has ever been known to produce; the ſulphureous waters containing (according to the analyſis given in the extract of the work juſt quoted) no leſs than *once and three quarters* its own bulk of ſulphurated hydrogen, with *once and a half* its bulk of carbonic acid gas. The chalybeate waters of Naples ſeem alſo to contain a much larger proportion of iron and carbonic acid gas, than any of the mineral waters hitherto analyſed.

The Medical Society gave, in the report just quoted, a very favourable account of Professor Attumonelli's Work.

Note H.—Page 34.

As it may be interesting to the Reader to have an opportunity of comparing the opinion delivered in this Report, by the French philosophers, on the imitation of mineral waters, with that of the latest English medical authors on the same subject, I shall transcribe here the following passage from Dr. Saunders's valuable work on the Medicinal Effects of Mineral Waters, in which he has pointed out in the fullest manner, both the advantages that may result from the artificial imitation of those waters, and the difficulties, which, in some instances, we may still encounter in attempting it.

" The composition of the most celebrated mineral waters having been known by accurate analysis, several ingenious men have endeavoured to confirm their experiments by synthesis; and to produce, by artificial means, a compound, in all respects similar to the natural preparation. To

 this

this too was added the additional motive of being able to ſupply the want of the natural waters, in places, and at times when theſe could not be procured. The illuſtrious Bergman, in his excellent treatiſe on mineral waters, has given very good ideas on the method of preparing them artificially; but ſome of the proceſſes which he propoſes, are imperfect, and liable to objections. Where the water to be imitated is only a ſolution of ſome neutral ſalts, ſuch, for inſtance, as the Epſom, Sedlitz, or Sea water, all that it is neceſſary to know, is the proportion in which they are contained in the natural ſpring; but the proceſſes of nature are not always imitated with ſo much eaſe. A greater difficulty lay in the way, which was, that of impregnating water with gaſeous ſubſtances to as complete a ſaturation, as is found in ſome of the moſt powerful mineral ſprings. This every chemiſt knows to be a very difficult object to attain, and impracticable with any of the more common apparatus now in uſe for ſuch purpoſes; but, under particular management, it has been attained, and ſome of the ſpecimens of artificially carbonated water that are to be ſeen, appear fully to equal in this reſpect the natural waters of Pyrmont or Seltzer. The ſaline and chalybeate principles may alſo be eaſily added, and the imitation will be complete for all medical purpoſes.

"Theſe artificial compoſitions have defects as well as advantages. With regard to the former,

we may obſerve, that it is always difficult to hit the ſame point of ſaturation with gas, and with the ſubſtances which the gas is to diſſolve; and this is particularly the caſe with every degree of ſaturation below the higheſt. Thus then, theſe medicines will not be ſo conſtantly the ſame as the natural ſprings; for uniformity of compoſition is a very conſpicuous feature in almoſt every one of theſe. However, as it is generally the *defect* of the natural waters to be too weak in theſe active ſubſtances, and as no material inconvenience appears often to ariſe from an exceſs of theſe gaſes, it is probable that with tolerable caution, theſe ſubſtitutes might be generally adopted, if requiſite.

"There are ſome kinds of chemical mixture, however, which art has not been able to imitate: the ſuſpenſion of ſiliceous earth in water, a curious and wonderful phenomenon in the hiſtory of many of the thermal ſprings, is a ſtriking example of this. If ſiliceous earth, apparently ſo inert and inactive on the body from its great difficulty of ſolution, ſhould ever be found to poſſeſs any medicinal properties, this will form a marked difference between the natural and artificial medicated waters. Perhaps the ſuper-ſulphurated waters of Aix, combined as they are with ſoda and with a high degree of heat, would exerciſe all the powers of the beſt chemiſt to imitate with ſucceſs. Several other combinations might be pointed out, in which,

if *perfect* accuracy of resemblance were required, we should still find the imperfection of art. Again, there is another case in which the natural water has a great advantage over the artificial; and this is, in some of the very compound thermal springs that are used for bathing as well as for a drink. It must be more difficult at all times to prepare a hot than a cold artificial water; and for the purposes of the bath, much advantage is gained by having a large body of water, as at Bath, Aix, and the like, where the patient can move his limbs about freely when immersed, and is surrounded with an atmosphere of steam, mixed with the volatile gaseous contents of the water, and where the heat is kept up much more permanently and uniformly.

" On the other hand, some peculiar advantages may be gained by the artificial preparation of medicated waters. Several of the most valuable natural springs contain substances which are either useless or positively detrimental. Pyrmont water, for instance, contains thirteen grains in the pint of calcareous salts, which render it very hard; and hence it may certainly prove inconvenient to some constitutions. Other neutral waters contain so little of their most active ingredient, as to require often an inconvenient bulk of liquid to produce the desired effect; as for example, where Scarborough or Epsom water are used as purgatives. All these defects may be remedied in the artificial

preparation,

preparation, by leaving out the uſeleſs and noxious matter, and encreaſing that in which the proper medicinal virtue reſides. Art likewiſe can prepare out of the ſame materials, new compounds, which would be conſidered as valuable natural treaſures, were ſuch found. Of this kind, I ſhould reckon a moderately dilute ſolution of a neutral ſalt, (vitriolated magneſia for inſtance) fully ſaturated with carbonic acid. This makes a very valuable addition to its powers as a medicine, from the known operation of this gaſeous acid in quieting irritation of the ſtomach, and rendering the ſurface of the body more cool and perſpirable; and beſides, it powerfully corrects the nauſeous taſte, which is in many inſtances a material objection to the neutral ſalts, eſpecially to a daily uſe of them as a gentle evacuant and alterative.

"One more advantage I would mention, which the artificial preparation of theſe medicines would promiſe, and this is, that of introducing much more ſimplicity in their compoſition than nature employs, and by this means we may be materially aſſiſted in forming preciſe ideas of the operation of every part of theſe important claſs of remedies, which the reader will readily ſee is a great object to be deſired by the philoſophical enquirer into the powers of medicine. Every one who examines into this ſubject, muſt be ſtruck with the great inaccuracy and confuſion of ideas that pre-

vail in the defcription of the operation of mineral waters, and the great fimilarity of effect afcribed to very different fpecies of this large and heterogeneous clafs of bodies. It has been my object in the preceding pages, to attempt in fome degree to introduce more precifion in inveftigating the powers of thefe bodies; but the fubject can never be fully canvaffed, till we are in poffeffion of a greater number of facts founded on experiment; and to promote this defirable end, the affiftance of art in imitating the proceffes of nature, may be called in with every profpect of advantage. In this view, therefore, the ftudy of the method of preparing mineral waters may be recommended to the medical enquirer as an interefting object of inveftigation.

" For the practitioner, who entertains a decided preference for the medicated waters which nature prefents, we may fuggeft the convenience of occafionally mixing different kinds of the fimple waters, in order to obtain the effects of fome of the more compound, which may not be at all times procured. Thus a Spa or Pyrmont water, mixed with that of the Sea or Epfom, will make a good imitation of the Cheltenham or Scarborough fpring, according to the proportion ufed; as the one furnifhes in abundance the carbonic acid and the iron, and the other, the neutral purgative falt; and each of thefe contain fo much of their active ingredients as to bear dilution, and yet to retain

confiderable

considerable efficacy. The synoptical table, which is added to the chapter on the particular waters, will, it is hoped, afford some assistance in this object.

" There is nothing more gratifying to the physician, who considers the healing art in its true light, that of an experimental science, than to be able to add to the general stock of professional knowledge, information which is to be afforded by the assistance of a collateral science. Of these, none is more intimately connected with medicine, by a community in many of the objects, than chemistry; and the aids which this science furnishes, are constantly encreasing, on account of the rapid accumulation of experimental knowledge. An enquiry into the nature and right application of mineral waters, is certainly not one of the least important objects of physic; since these are remedies that have been at all times peculiarly favourites with the public, and have deserved, from their real efficacy, much of the esteem in which they have been held. The substances concerned in the composition of these waters, are such as come particularly under the accurate and distinguishing eye of modern chemisty, and admirably illustrate some of its most beautiful discoveries. They have engaged the attention of the ablest chemists for many years in various countries, and the importance attached to these enquiries, has

abundantly

abundantly repaid the labour and difficulty of the refearch.

"Impreffed with the idea, that the fcience of of chemiftry has done more to illuftrate this, than almoft any other clafs of natural fubftances that are ufed medicinally, it has been my wifh in the foregoing pages to lay before the public a general view of our prefent ftate of knowledge on this fubject; in order to afcertain, with fome precifion, the practical advantage to be derived from thefe facts. Viewing, with fome regret, the apparent flight which has been thrown upon thefe enquiries by fome, whofe profeffional knowledge attaches much weight to their opinions, I have endeavoured to clear away fome caufes of error, arifing from too partial and confined a view of the fubject; in order that the leading features of medical chemiftry, attached to thefe enquiries, may be rendered more confpicuous; and my object in undertaking this work will be anfwered, if thefe pages will at all contribute to the advancement of the healing art."

THE END.

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